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LIVESTOCK AND RANGE RESEARCH  
AT THE  
UNITED STATES RANGE LIVESTOCK EXPERIMENT STATION //

I Seventieth Annual Convention *not 49.9*  
Montana Stockgrowers Association. *m76*  
May 20-22, 1954



✓ U.S. Agricultural Research Service //  
United States Department of Agriculture  
and the  
// Montana Agricultural Experiment Station, *Bozeman.*





## INTRODUCTION

The importance of the livestock industry to the economy of Montana and other western states, where most of the land is best adapted to livestock production on a range basis, is not always appreciated. Bankers, businessmen, stockmen, and others should recognize that a high proportion of the total land area of Montana should remain in grass and be utilized for livestock production.



Aerial view of portion of the experiment station range  
with the Yellowstone Valley in the background.

Unlike certain other areas in the United States, notably the southeastern and south central portions, agricultural development in Montana is limited by climatic (primarily rainfall) and topographical conditions. This fact makes the prosperity of a stable livestock industry in this area largely dependent upon economical operating costs. The use of spreader dikes, ditches and stock and irrigation reservoirs on areas similar to the one pictured above offer almost unlimited possibilities for increasing the carrying capacity of individual range units. This is one of several ways to meet competition from other areas.

Another opportunity for more economical operations may be found in improved livestock nutrition. The small calf crops and high percentages of stillbirths following drouth years are clear evidence of the importance of proper nutrition for range cattle. There is also a growing recognition of the importance of supplemental feeding to correct certain seasonal deficiencies.

The third factor to be considered in livestock operations is improvement through breeding. Most of the current experimental work at this station is concerned with this phase, although nutrition and range improvement studies are also in progress. The relative importance of breeding and nutrition in animal improvement has been debated for years. Needless to say, both are important and necessary to each other. Productive livestock are often limited by the quantity or quality of their feed, but sound breeding practices should be the foundation of the livestock industry since they represent permanent improvement.





## BREEDING PRODUCTIVE CATTLE

In the past most of the emphasis in efforts to improve beef cattle has been toward selection for body type and uniformity. The divergence of our beef and dairy types from a common foundation stock was largely due to such selection. However, there are other breeding methods that have been tried and adopted in the improvement of both plants and other animals which may be of value in beef cattle breeding. Of such methods those currently being studied at this station are (1) production testing or sire indexing, and (2) the development of inbred lines.

### Production Testing

Testing for production is the accepted practice in the improvement of dairy cattle. Dairy bulls are rated according to the milk production of their daughters. The strictly meat animals--beef cattle and swine--have not been selected on production records to any appreciable degree because of the improvement that has resulted from selection for thickness of fleshing. But there are other important characteristics which may not be observable when looking at an animal. The most important are milking ability, gaining ability, efficiency (pounds of feed per pound of gain), and carcass quality.

### Effectiveness of selection for gaining ability

In 1944 when the Montana Stockgrowers Association met in Miles City the results of the steer feeding trial for the preceding year were presented. Included in the steers fed in 1943 were 4 groups sired by bulls from our inbred Line I. In 1953 one of the sire groups was again out of a Line 1 bull. Both years these steers were calved in April and weaned in October. They were fed until July on similar rations. Their comparative records are shown below:

	<u>1943</u>	<u>1953</u>
Average weaning weight at 190 days	442	456
Average daily gain in feedlot	1.99	2.48
Average final weight out of feedlot	904	1,064
Feed per cwt. gain (grain)	586	593

Our records indicate that weaning weights are so dependent upon annual rainfall that a two year comparison may not be valid. Nevertheless, in 1942 (the year that the first steers were weaned) there was 14 inches of precipitation. In 1952, the precipitation was only 10 inches. On the basis of these figures we can assume some improvement in weaning weights in addition to that shown above. The increase in gains was approximately one-half pound per day (25%). Efficiencies appear to have changed little from 1943 to 1953. However, it must be remembered that efficiency decreases as fattening increases and that the 1953 steers finished 160 pounds heavier in the same number of days and at the same efficiency.

### Gaining ability highly inherited

The average daily gains of the steers being fed this year as recorded on April 21, and the records of their sires are as follows:

Sire group	Avg. daily gain of steers	Relative rank steers	Relative rank bulls	Avg. daily gain of bulls
1	2.22	7	6	2.43
2	2.55	3	4	2.57
3	2.61	2	2	2.85
4	2.66	1	1	2.97
5	2.42	5	5	2.53
6	2.52	4	3	2.84
7	2.25	6	7	2.22



Although there was no selection for gaining ability in the dams of the steers, note how closely the gain records of the bulls and steers compare even at this period in the test.

Since the gaining ability of bulls is so highly indicative of the gain of their offspring, a number of breeders have adopted sire indexing to improve the gaining potential of their bulls. Some states have central testing stations where bulls are brought in for gain tests. Differences in gaining ability are reflected by gains on grass as well as in the feedlot according to unpublished data from the North Montana Branch Station.

#### Carcass studies important to further improvement in quality of beef

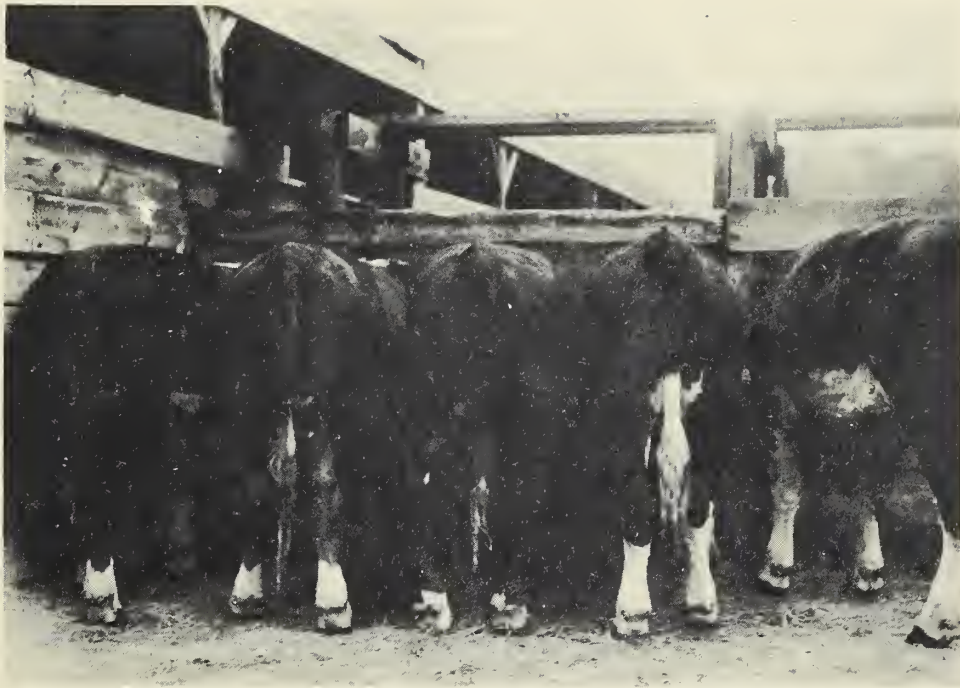
More attention to beef quality is of increasing importance in our highly competitive food markets. Inasmuch as breeders seldom have the opportunity to make the detailed carcass appraisals which are the true measure of the effectiveness of their breeding methods, there must be an increasing amount of work in this field by the experiment stations.

In the past 10 years over 600 steers have been fed out at this station, and their records before weaning, in the feedlot, and after slaughter have been carefully examined. Findings to date are given below:

- (1) It is impossible to select fast gaining calves from their appearance at weaning. It is possible to select with some degree of accuracy those steers that will eventually hang the best carcasses.
- (2) Weights of the calves at weaning have little effect upon the eventual carcass grade. Selection can be made for adequate milking ability without reducing natural thickness of fleshing.
- (3) Selection for gaining ability alone will not improve fleshing characteristics. Nor will selection for conformation alone improve gaining ability. Selection for each must be done independently--a fact which stresses the need for gain records of breeding stock.
- (4) A grade just prior to slaughter serves as a fairly good estimate of the value of the carcass. It is a better estimate of the amount of fat in the carcass than of the amount of lean however.
- (5) Selection for thickness of fleshing in the live animal as a method of carcass improvement can be faulty in that the amount of lean and fat in an animal may not increase proportionately. We may select only for excess fat.







Group of steers out of grade cows and sired by Advance Domino 20, one of the foundation herd sires of Line 1. This picture was taken in South St. Paul in 1938.



Group of steers sired by a Line 1 bull (a great-grandson of Advance Domino 20), just before shipment in 1953.



## Development of Inbred Lines

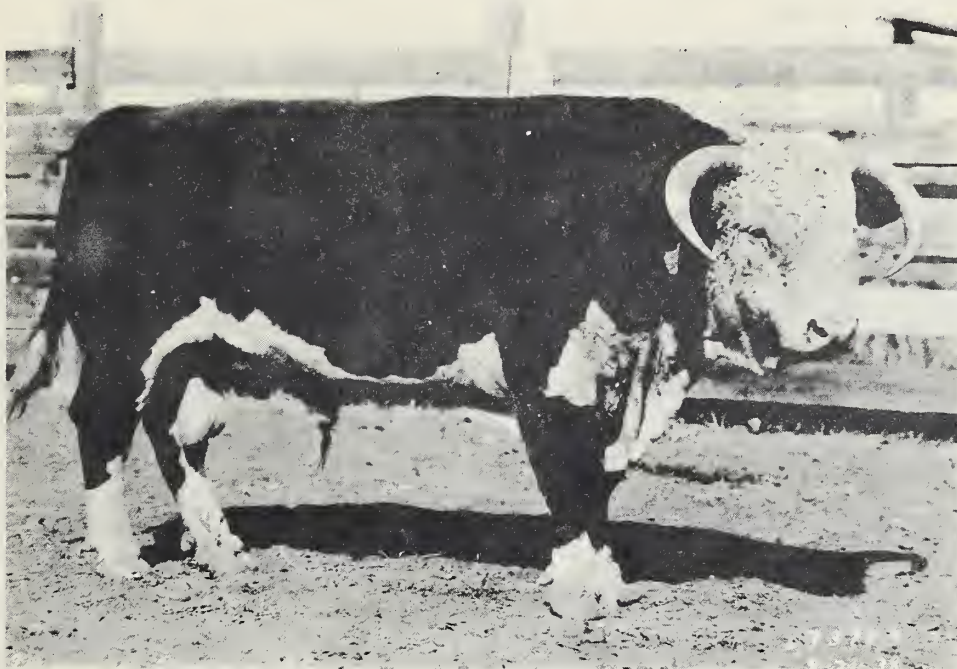
The general results of inbreeding are an overall reduction in vigor, an increase in prepotency, and a reduction in inherited variation.

The possible advantages of inbreeding result from fixing desirable characteristics in an individual or line so that they breed "true", the development of hybrid vigor from crossing inbred lines, and the detection and elimination of lethals.

This station has worked with a total of 13 inbred lines of Herefords collected from various western states. Most of the lines have been established by purchasing related bulls and heifers from individual herds. Each line is maintained as a closed herd with no outside blood being introduced, and selection within the line is based upon a production test and selection for thickness of fleshing.

### History of Line 1 indicates continuous improvement

Line 1 was founded in 1934 with the purchase of two half-brothers who were bred to unrelated cows in the station herd. The herd has been closed since 1934. When the record of a son of one of the herd sires surpasses the record made by the herd sire he replaces him in the herd. Present herd sires are great-grandsons or great-great-grandsons of the two foundation bulls. Results to date show that the line has improved in gaining ability and weight for age. Tests by the Ohio Station have shown that steers from Line 1 bulls excelled outbred steers in the feedlot.



Advance Domino 20, one of the two foundation sires of Line 1. This bull was purchased at the Denver show in 1934. At the top of page 4 is pictured a group of steers sired by this bull. A comparison of these steers with those at the bottom of page 4 will illustrate what has happened in the line since it was founded.







L1 Domino 94--one of the present herd sires in Line 1. He is a thick rapid growing bull and weighed 1,888 pounds when he came out of the breeding herd last summer. He is now a four-year-old.

#### Cross-line matings a possible method of increased production within a breed

A number of crosses have been made between the inbred Hereford lines on the station. It is this method of breeding that is the basis of the hybrid corn industry, although in corn breeding crosses are made between inbred lines from different varieties. In cattle this would correspond to crosses of inbred lines of different breeds. Some crosses at the station have been quite productive and others only about equal to the parental lines. An example of the hybrid vigor that may result within a breed from crosses of inbred lines is evidenced in the 1953 fall weights of yearling heifers from Line 1 X Line 10.

	<u>Line 1</u>	<u>Line 1 X Line 10</u>	<u>Line 10</u>
Average fall weight	799	876	807

#### Inbreeding may have increasing use as a breeding method

Evaluation of inbreeding as a method of improvement is a long-time project because generation intervals in beef cattle are from two to four years, depending on the time that heifers are first bred. Furthermore this station has practiced relatively mild inbreeding with first emphasis on production, which means that a number of generations will have to be studied before many definite conclusions can be made. Observations to date include the following:



- (1) Only outstanding foundation stock can be satisfactorily inbred and it may take several generations to determine the genetic potential of a line.
- (2) Some lines "nick" well with almost any other line of breeding and the crosses are superior to both parental lines. Such lines are in the minority however.
- (3) Continuous careful culling is necessary when inbreeding.
- (4) A bull that is definitely known to produce calves considerably superior to the herd level can be used to advantage for several generations.
- (5) Outcrossing bulls from one line of breeding on heifers from another line with which it combines or "nicks" well is a method whereby the purebred breeder can continuously supply the same range herd with good results.

#### Related Research Now in Progress

##### Hereditary susceptibility to cancer eye

A study of the incidence of cancer eye shows that approximately 4% of the cows that have been in the station herd were affected by cancer eye. This closely approximates the amount reported by a California station, and certain herds in the southwest reportedly have a higher incidence. There was found to be a definite hereditary susceptibility to cancer eye in this herd. A total of 18% of the daughters of two sires, (half-brothers), developed eye cancer. Daughters of other sires had a very low incidence of cancer eye. Losses from cancer eye could be reduced if the purebred breeder would cull bulls that are from cows which develop cancer eye. The rancher should ear-mark heifer calves from cows with cancer eye so they can be culled before replacements are selected.

##### Prolapsus of vagina or uterus influenced by both breeding and nutrition

Preliminary evidence collected to date indicates that the tendency to prolapse is inherited. The number of prolapses from year to year has varied enough to suggest that nutrition is a contributing factor as well. Further research is needed on this problem before the influence of nutrition can be established.

The only recommendations for the reduction of prolapsus that can be made at the present time are the same as were suggested for cancer eye. Most ranchers cull all cows that prolapse as well as those with cancer eye, but very often some heifers have already gone back into the herd from these cows. The most effective culling will be done in purebred herds where individual records are available.

##### Detection of lethals still in exploratory stage

There is an apparent increase in the amount of dwarfism and other lethals occurring in beef cattle. This station, along with other agricultural experiment stations, is studying devices such as the profilometer that may be used to detect the carriers of such lethals. Another experiment, being conducted in cooperation with the University of Wyoming, is concerned with the use of blood types as a possible method of detecting carriers and also as a method of sire identification and prediction of future production.





## Selection for lighter birth weights may be of value in calving two-year-olds

There are wide differences in birth weights of calves from different sires. At the present time the grade cows in the station herd are dropping calves from sires of seven different lines. These cows were assigned to breeding herds last summer with every effort being made to shape up each herd with an equal production potential. Then observed differences in their progeny are primarily due to the influence of the bull. Average birth weights to date average from 88 pounds from one sire group to 76 pounds from another group. Birth weight is highly heritable so it is advisable to select, if possible, bulls with a low birth weight to breed to yearling heifers--another illustration of the value of a production record for a sire.

## GRAZING RESEARCH

Grazing studies at this station are being conducted in cooperation with the Field Crop Division of the Agricultural Research Service. Range management, grazing, and reseeding experiments were started in 1932. Studies have been made of various grazing intensities to determine the optimum use of Northern Great Plains ranges. Necessarily included in such a study have been determination of soil moisture, moisture infiltration, and soil compaction; plant density, composition and production; and livestock fertility and weights on the various intensities.

## Intensity of grazing affects fertility as well as production of cows

Experimental pastures have been grazed at the rate of 23, 31, and 39 acres per cow per year for approximately 20 years. It has not been possible to replace cows with calves that have been raised under the same intensity of grazing until the past 7 years. The record of the calf production of these cows is as follows:

	<u>23 acres</u>	<u>31 acres</u>	<u>39 acres</u>
Calving percentage	70	89	90
Avg. daily gain of calf to weaning	1.6	1.8	1.9
Pounds of calf produced per cow at weaning	243	362	378
Pounds of calf produced per acre at weaning	10.5	11.9	9.8

The figures pertaining to production per acre deserve some qualification since they do not take into account the continuous deterioration occurring in the heavily grazed pastures.

## Recommended stocking rates for this area

Optimum grazing intensity depends primarily on three factors: average precipitation, range site, and range condition. For the ordinary upland site at this station, which is typical of a considerable area, the recommended rate of stocking is 35 acres per cow per year and 5.4 acres per yearling ewe for an 8 months' season--assuming that the range is in good condition.

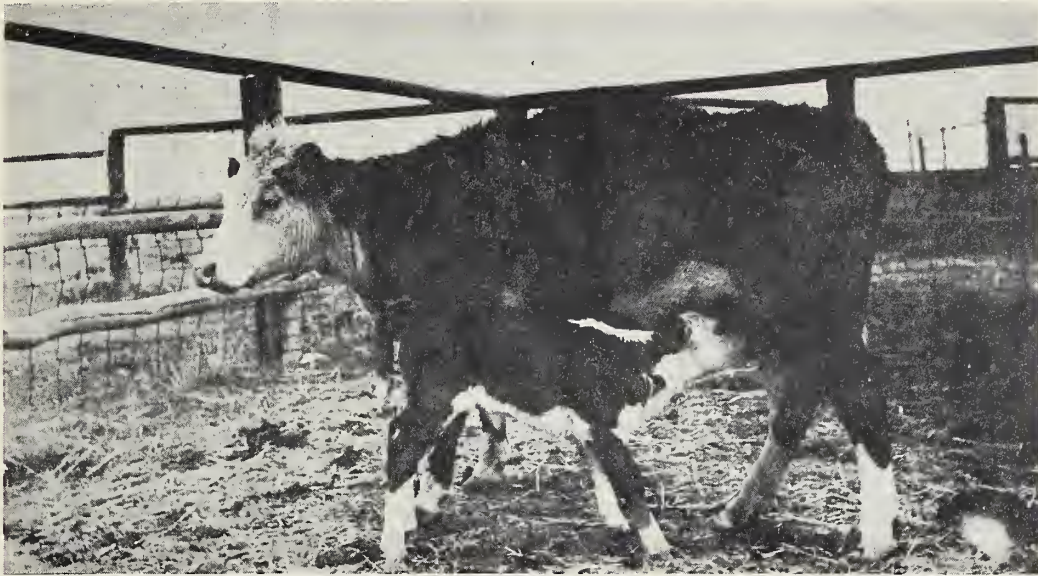
## Several new grass varieties offer promise of more productive and often earlier grazing

In addition to crested wheatgrass several other species and varieties of grasses are being tested for this area. They include big bluegrass, intermediate wheatgrass and Russian wild-rye. The recommended rate of stocking for crested wheatgrass pastures in this area is .8 acre per cow per month for an average grazing season of 3½ months. Obviously, stocking rates are recommended on the basis of long-time averages because of the wide yearly variations in precipitation.



### Range deficiencies most acute under heavy stocking

Pictured below is a cow from one of the heavily grazed pastures in the grazing experiment. She is typical of about 20% of the cows in the heavily grazed pastures.



The cow shown above is exhibiting typical deficiency symptoms. Notice the high arched back directly back of the shoulders and the low loin. Only cows in the heavily grazed pastures exhibit these symptoms.

### Importance of browse in winter pastures shown by chemical analyses

Four of the more important browse species of this area, greasewood, winterfat, shadscale, and big sagebrush were studied to determine how heavily they were grazed during the winter. Chemical analyses of each shrub were made for protein, phosphorus, and carotene (the substance from which Vitamin A is derived) at monthly intervals from November through March.

Greasewood and winterfat were grazed most heavily. Shadscale was grazed to a lesser degree, and only 1% of the sagebrush was utilized.

The protein content of greasewood compared quite closely with that of native hay. The other shrubs averaged only one or two percent less.

The phosphorus content of all species was a little below the recommended nutritional level.

Carotene in all species increased sharply during January of each year. Just before growth began in the spring it dropped to the lowest point of the year. Carotene content was adequate for proper cattle nutrition for the majority of the winter, however.





## SWINE INVESTIGATIONS

The Hamprace or Montana No. 1 hog was developed at the United States Range Livestock Experiment Station, Miles City, Montana. This inbred line of hogs is the result of a cross between the Landrace and the unbelted Hampshire breeds. The principal object of the experiment was to combine the more desirable qualities of each of the parental strains into a new inbred line of hogs. Prolificacy, mothering ability, economical gains, and desirable carcasses of a meat-type hog were performance characters that were emphasized in the development of the Hamprace. It was also planned that this inbred line would later be crossed with another breed to test its performance as a cross to produce a better market or meat-type hog, taking advantage of hybrid vigor that usually results from crossing or lines of breeds.

Performance records of Hamprace or Montana No. 1 hogs show that the desired results were very successfully obtained. Slaughter data show that a high percentage of carcasses meet the demands for a top quality product with the emphasis on meat-type.

In one phase of the development of this breed, intensive inbreeding was practiced in developing sub-lines to be used in cross-line matings. Performance declined somewhat with the increase in the amount of inbreeding, but the Hamprace hog has probably exceeded any breed in the entire country in its ability to perform successfully with this level of inbreeding. Inbreeding has now reached 70% in some of the sublines.

In the first cycle of an experiment to test combining ability between the Hamprace and Yorkshire breeds excellent results have been achieved. The following is a summary of last year's test.

	No. <u>Farr-</u> <u>owed</u>	No. <u>Wea-</u> <u>ned</u>	Weaned <u>weight</u>	Avg. <u>daily</u> <u>gain</u>	Feed/100 <u>pounds gain</u>
Hamprace control	9.7	7.6	238.6	1.67	338
York boars x Hamprace gilts	11.5	9.3	314.6	1.74	347
Hamprace boars x Yorkshire gilts	9.6	8.7	306.4	1.72	325

Purebred stock is being raised this year to be used for cross-breeding next year.





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